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# Design of the Automatic Door Opening System for People with Limited Mobility

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***Abstract*: *In this article a design concept of a door is proposed, taking into consideration the principles of universal design, equipped with an automatic opening system for elder or disabled people***

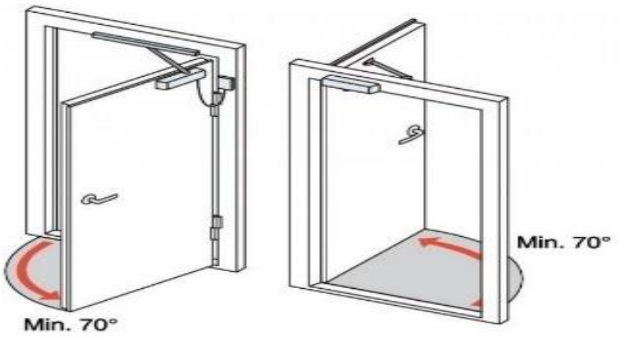
***Keywords: universal design, automatic doors, automatic door design.***

## I. INTRODUCTION

People with limited mobility, such as wheelchair users, disabled persons, and elderly people face the problem of enteringresidential buildings. Most of the times, the doors of a building are quite heavy and open outwards in accordance with fire safety standards, thereby creating difficulties for many groups of citizens to enter. This article will propose the modification of the access area, including the door itself, by proposing a universal design of an automatic door opening system for the elderly and disabled people[1]-[3].

## II. METHODOLOGY

An ideal solution for equipping entrances is, of course, the installation of automatic sliding doors, but not all houses fit for the installation of such doors. Therefore, the solution to this problem is to install a mechanism, which automatically opens doors to a swing door already standing in the entrance. In addition, this mechanism is very easy to put into operation, as it only requires 220V power supply to run. (Fig. 1).

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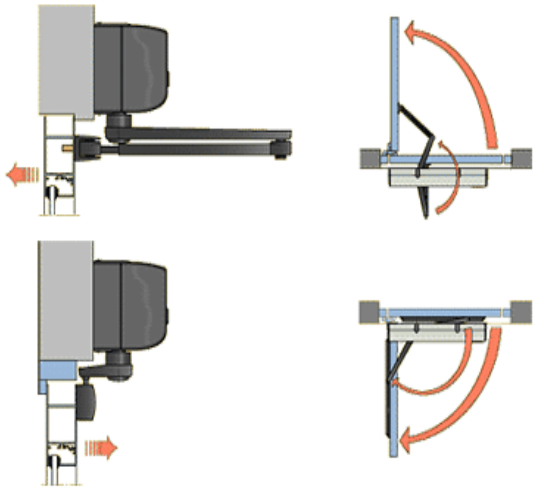

**Fig. 1.Openingmechanism of a swing automatic door.**

## III. ALGORITHM

Absolutely any swing door in a residential building can be automated using such a device. It is installed on a regular swinging mechanical door as a regular door closer from the outer or inner side of it. (Fig. 2) [4].

**Fig. 2.Automatic drive for opening the access door.**

The designed access door will open with a radio wave bracelet. A radio wave sensor is installed on a panel near the door. In order to enter, one will need to bring the bracelet near the panel. Then the automatic door opening mechanism will work. As for the design of the bracelet, the abbreviation SAOD will be located on the front part (short for “automatic door opening system”). The bracelet itself will be made of silicone, as this material has high durability and is resistant to

aggressive environments. Waterproof, absolutely hypoallergenic material (Fig. 3).


**Fig. 3.Radio wave bracelet.**

It is supposed to modify the design of the entrance area itself. If there is a staircase in front of the door, a ramp must be installed in accordance with SNIP 35-01-2001.

Ramps must be in accordance with SNiP 35-01-2001 guideline, thus, for wheelchair users, the following characteristics apply:

- The maximum height of the lifting structure (one march) must not exceed 0.8 m.
- The angle of inclination should not exceed 8%. If the height difference is less than 0.2 m, the slope can reach 10%.
- The width of the ramp should be at least 1.0 m for the comfortable movement of the disabled wheelchair unilaterally on the horizontal section of the ramp
- The size of the platform for the person to turn around must be at least 1.5 m[6], [7].

It is also necessary to install the ramp so that the door does not prevent the entry into the building. A doorphone with an ordinary key for entry (the door opens manually) will be placed on the door panel, then a special radio wave sensor will be located below, which will pick up radio waves coming from a specially designed bracelet for people with limited mobility. Thus, the door will open automatically, allowing you to get into the building (Fig. 4).

The entrance door will be made of aluminum in accordance with the requirements specified in GOST 237447-88; SP 128.13330.2012. The door will be made with a special attachment - a thermal bridge, which should prevent freezing and minimize thermal conductivity. The main material for the heat-insulating element is polyamide, which guarantees high performance, as well as sound, heat insulation, moisture resistance [5].

The door design uses anodizing aluminum sheets with subsequent painting, which will mimic the color and texture of a tree, with an image of a forest on top of it (Fig. 5).

The design will be put to action using UV printing technology on an anodized aluminum sheet. To begin with, aluminum is processed in an electrolyte on a galvanic line. Due to this, a microcellular structure “grows” on the surface of aluminum. When stained, dye particles enter these cells. Next is the fixing process – “boiling” in a solution at a temperature of 95C. With this treatment, the porous layer changes its structure. After fixing, the dye is protected from external influences by the oxide layer [8], [11]. Thus, this method guarantees image stability for more than 50 years.


**Fig. 4.Access area design.**

**Fig. 5. Design of automatic door opener system**

The comfort of using doorways for people with disabilities is determined by the dimensions of a wheelchair [9], [10]

The design of doorways must be in accordance with SNiP 35-01-2001 guideline, thus, for wheelchair users, the following characteristics apply:

- In the case of designing the entrance doors of new buildings and structures, the width must be of at least 1.2 m.
- In the case of designing reconstructed, capitally renovated and adaptable existing buildings and structures, the width of the entrance doors ranges from 0.9 to 1.2 m [3].

## IV. RESULT ANALYSIS

Having considered the above methodology and using all the necessary regulatory acts when designing the access area, as well as observing the methodology for making the access door, we take into account all the requirements that contribute to the comfortable use of the entrance group by people with disabilities. As a result, the proposed methodology for the development of a universal design of an automatic door opening system for people with limited mobility will create equal conditions for using the entrance group for all categories of citizens.

## V. CONCLUSION

Thus, the developed design of the entrance zone and the door will make entry and exit from the entrance comfortable

for all groups of citizens while realizing the principles of universal design. A door equipped with an automatic opening mechanism should be a prerequisite when designing the access area of residential buildings in order to create a comfortable living environment for all groups of the population. In many European countries, wherever there may be difficulties with opening doors and difficulties entering the building, such measures have already been introduced to create equal conditions and opportunities for different categories of citizens.

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